

FOLDABLE DISPLAY DEVICE, RELATED ELECTRONIC DEVICE, AND RELATED METHOD

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority under 35 USC § 119 to Korean Patent Application No. 10-2013-0144271, filed on Nov. 26, 2013 in the Korean Intellectual Property Office (KIPO), the contents of the Korean Patent Application being incorporated herein by reference.

BACKGROUND

[0002] 1. Technical Field

[0003] The present invention is related to a foldable display device, an electronic device that includes the foldable display device, and a method related to the foldable display device.

[0004] 2. Description of the Related Art

[0005] An electronic device (e.g., one of a cellular phone, a smart phone, a smart pad, a computer, a laptop, a television, etc.) that includes a foldable display device may provide better portability than a similar electronic device that includes a generally non-foldable display device. Nevertheless, as folding operations and unfolding operations of the foldable display device are repetitively performed, a bent portion of the foldable display device may become undesirably (and permanently) deformed. For example, the bent portion of the foldable display device may become creased. As a result, images displayed by the foldable display device may be distorted at the bent portion of the foldable display device, such that the image display quality of the foldable display device may become undesirable.

SUMMARY

[0006] Example embodiments may be related to a foldable display device capable of substantially preventing, minimizing, and/or removing creases at a bendable portion of the foldable display device. Image distortion at the bendable portion of the foldable display device potentially caused by creases may be substantially prevented or minimized. Advantageously, the foldable display device may display images with satisfactory quality. Embodiments of the invention may be related to an electronic device that includes the foldable display device. Embodiments of the invention may be related to a method for controlling a surface structure of the foldable display such that creases may be substantially prevented, minimized, and/or removed.

[0007] Embodiments of the invention may be related to a display device that may include a foldable display member. The foldable display member may include a first portion, a second portion, and a bendable portion. The first portion may be connected through the bendable portion to the second portion. The display device may further include a first controllable member that may overlap the bendable portion. The display device may further include a control unit connected to the first controllable member and configured to provide a first signal to control a size of the first controllable member according to a magnitude of an angle between the first portion and the second portion.

[0008] In example embodiments, the first signal is configured to control the first controllable member to enlarge if the

angle is reduced, and wherein the first signal is configured to control the first controllable member to contract if the angle is enlarged.

[0009] In example embodiments, the first signal may be a voltage.

[0010] In example embodiments, the control unit may be further configured to determine a value of the first signal according to a surface condition of the bendable portion.

[0011] In example embodiments, the display device may include a memory device. The memory device may store a mapping relation between values of the first signal and magnitudes of the angle. The control unit may be configured to determine a value of the first signal using the mapping relation.

[0012] In example embodiments, the memory device may be configured to update the mapping relation according to degradation of the bendable portion.

[0013] In example embodiments, the first controllable member may include a first terminal and a second terminal. The first terminal may be electrically connected to the control unit. The second terminal may be electrically connected to a ground.

[0014] In example embodiments, the first terminal may be electrically connected through a switching element to the control unit.

[0015] In example embodiments, the display device may include a second controllable member that may overlap the bendable portion. The first controllable member may overlap a first region of the bendable portion. The second controllable member may overlap a second region of the bendable portion. The control unit may be connected to the second controllable member and may be configured to control a size of the second controllable member.

[0016] In example embodiments, the display device may include a first switching element electrically connected between the control unit and the first controllable member. The display device may further include a second switching element electrically connected between the control unit and the second controllable member.

[0017] In example embodiments, the control unit may be configured to provide a second signal to control the size of the second controllable member. A value of the second signal may be unequal to a value of the first signal when the control unit provides first signal and the second signal simultaneously.

[0018] In example embodiments, the control unit may be configured to provide a second signal to control the size of the second controllable member. A value of the second signal may be determined by the control unit according to a surface condition of the second region of the bendable portion.

[0019] Example embodiments of the invention may be related to an electronic device that may include the following elements: a first body member; a foldable display member overlapping the first body member and including a first portion, a second portion, and a bendable portion, wherein the first portion is connected through the bendable portion to the second portion; a controllable member overlapping the bendable portion; and a control unit connected to the controllable member and configured to provide a signal to control a size of the controllable member according to a magnitude of an angle between the first portion and the second portion.